sidered as November–April; and that the precipitation which occurs outside that winter period, unless abnormal, has relatively little effect in varying the run-off. In other words, it would seem that the winter snows afford the main supply from which the entire year's run-off occurs. Table No. 2 (not reproduced) gives the data shown on Diagram No. 2.

The purpose as stated above for attempting to show the relation expressed by the curves on the diagrams is to permit estimating probable water supply as far in advance as possible. During the period August–February the flow of Bear River is relatively steady and not subject to great range in stage. Hydrographs show much less variation in form during this nonflood period than occur during the flood period. Such being the case, it should be possible to fairly accurately estimate in advance the monthly run-off during the nonflood period by using the form shown by the hydrographs of previous years, being guided as to total quantity by the relation shown in the diagrams.

NOTES, ABSTRACTS, AND REVIEWS.

RESIGNATION OF DR. C. F. BROOKS.

Charles F. Brooks, Meteorologist, United States Weather Bureau and Editor of the MONTHLY WEATHER REVIEW, resigned on June 30, 1921, to accept a newly created associate professorship in meteorology and climatology at Clark University, Worcester, Mass. He writes as follows concerning his new work:

Dr. Wallace W. Atwood, the new president of Clark University, is developing a graduate school of geography. He fittingly recognizes that one of the first requisites in any well-rounded system of instruction in geography is a study of climates, for the atmospheric conditions control to a large extent both the agricultural products and the living habits of man. President Atwood also appreciates that climatology can not be taught adequately without the physical aspects of meteorology. Thus, beginning in the Summer School of 1921, elementary and advanced courses and opportunities for research in both meteorology and climatology are offered. The titles of those to be given in the winter semester are: Meteorology, The Passing Weather, Climatology, Climates of the World, Climatic Environments of the White Race. A fairly complete weather-observing station is being established, primarily for purposes of instruction.

The plan of Clark University includes research as well as teaching. For example, each member of the staff of the School of Geography is expected to spend several months every two years in travel. The results of each expedition are to be published within a year after the return.

The United States Weather Bureau has been most helpful in various ways, especially in providing publications for the university library.

This addition to the all-too-few institutions offering graduate instruction in Meteorology and Climatology is welcomed by the Weather Bureau as providing another source from which its scientific personnel can be recruited.—*A. J. H.*

THE AURORA OF MAY 14-15, 1921.

A brief summary of this brilliant and noteworthy aurora will be presented in the next issue (June) of the REVIEW. Sufficient data were not available in time to include the account in this REVIEW.—*A. J. H.*

FATHER FROC, S. J., HONORED BY FRANCE.

From *Nature*, London (May 5, 1921, p. 308), we learn that the French Government has awarded the Cross of the Legion of Honor to Father Froc, S. J., who for more than a quarter of century has been connected with the meteorological work at Zi-ka-wei Observatory. It was at the Jesuit observatory in Manila that Father Faura in 1879 for the first time predicted the existence, duration, and course of a typhoon in the Far East, and the work at both Manila and Zi-ka-wei has been of the greatest importance to those who sail the China seas. Zi-ka-wei, which stands about 4 miles from the international settlement of Shanghai, derives its name from a distinguished Chinese who was converted to the Christian faith by Matthew Ricci 300 years ago, and whose grave lies close to the observatory. Besides the observatory the Jesuit mission has here a fine cathedral, a college, an orphanage, a convent, and a natural history museum. The work of Father Froc and of his colleagues, Fathers Chevalier and Gauthier, has the support of the community at Shanghai, and the observatory at Zi-ka-wei and those at Zose and Liu-ka-pong connected with it are an object lesson to the Chinese Government.

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ORIGIN OF THE SOUTHWEST MONSOON.[1]

By G. C. SIMPSON.

[Reprinted from *Nature*, London, Mar. 31, 1921, p. 154.]

It has generally been held that the southwest monsoon owes its origin to the great difference of temperature which exists during the summer months between the heated land surface of India and the surrounding oceans, the general idea being that the warm air over the land rises, and damp air from the sea flows into India to take its place, thus resulting in the strong southwest winds, the rainfall itself being due to the cooling of the air as it rises over India.

This theory has to face the difficulties that the temperature over India is much higher in May, before the monsoon sets in, than it is during the monsoon itself; that the temperature is higher in years of bad monsoon than in years of good monsoon; and that the part of India which has the highest temperature and the lowest pressure, and where ascending currents should be the greatest, is a region of practically no rainfall throughout the monsoon.

The true explanation of the southwest monsoon can be obtained only by taking a wide view of the weather conditions over large parts of the earth's surface during the summer months in the Northern Hemisphere. It is then seen that the southwest winds are not due to the temperature in India, but are a relatively small part of a general circulation of the atmosphere caused by a region of high pressure over the South Indian Ocean and a region

[1] Abstract of a paper entitled "The Southwest Monsoon," read to the Royal Meteorological Society on Wednesday, March 16

of low pressure which extends over the whole of Central Asia. Air passes northward from the region of high pressure as the southwest trade winds so far as the equator, where it gets caught up in the circulation around the low pressure over Asia. On account of the particular arrangement of sea and land, combined with deflection of wind currents due to the earth's rotation, this air travels for 4,000 miles over the sea before it reaches India, where it arrives in a very warm and exceedingly humid condition. This air, however, would probably sweep right across India to its goal in central Asia without producing much rainfall if it were not for the unique distribution of mountains around India. From the north of the Mokran coast, right around India, following the line of Afghanistan, the Himalayas, and the mountains of Burma, there extends an unbroken wall of mountains, nowhere lower than 5,000 feet, standing directly athwart the air currents. The mountains catch the air, which is being driven by a pressure distribution extending from the Southern Indian Ocean to the center of Asia, in a kind of trap, out of which there is no escape except by ascension. The damp, humid air, which begins to rain as soon as it rises 500 feet, is forced to rise between 10,000 feet and 20,000 feet, and, in consequence, large masses of water are precipitated over the greater part of the Indian area.

STORM WARNINGS IN INDIA.

The Meteorological Department of the Government of India has issued its report on the administration in 1919–20. Observations in connection with the upper air have been developed on behalf of the aviators who are from time to time crossing India. Storm warnings for stations in the Bay of Bengal and in the Arabian Sea are said to have been carried out successfully. It is, however, admitted that the warning of the storm which caused much damage to life and property in eastern Bengal on the night of September 24, 1919, was inadequate. Inland stations were not communicated with until early evening, and were then informed that a "slight to moderate storm" was expected. Special arrangements have been made to avoid the repetition of a similar mishap. The storm, which was tracked from September 22–25, developed rapidly as it approached, and crossed the Bengal coast as a cyclone about noon on September 24. It reached Dacca at about 2.30 a. m. on September 25, and finally broke up on that day in the Assam hills. At the center the deficiency of pressure was about 1¼ inches, and the calm area at least 15 miles in diameter. The total loss of life is estimated at 3,500. The value of property destroyed was probably greater than in any storm in Bengal for the last 200 years, but the destruction of human life was probably greater in the Bakarganj cyclone of 1876. An additional terror was caused by a vivid red glow appearing in the sky during the period of the lull. Details are given of the several storms which occurred during the year. Flood warnings are issued and the results are said to be very satisfactory. Rainfall data were received for publication from nearly 3,000 stations for the year.—*Nature (London), April 28, 1921, pages 279, 280.*

OCEAN SURFACE-CURRENTS INDICATED BY DRIFT-BOTTLES AND OTHER OBJECTS.[1]

During the summer of 1919 the Biological Board of Canada set out 330 drift bottles in the Bay of Fundy. Sixteen of these have been picked up on the shores of the Gulf of Maine. Each bottle contained a Canadian postcard on which was printed besides the address of the Biological station, the offer of a reward to the finder who wrote the time and place of finding, and posted the card. Two sizes of bottles were used—2-oz. and 8-oz.; to the latter a galvanized-iron drag was attached to hang at a depth of 3 fathoms, the object of the drag being to minimize the direct effect of the wind. Of the 55 bottles with drags, three were picked up on the Cape Cod peninsula, and three on the Maine coast. Of the 275 bottles without drags, eight were found on Cape Cod and two on the Maine coast. Seven of the bottles (of both sizes) which reached Cape Cod were found after an elapse of between 73 and 80 days. The direct distance between the Bay of Fundy and Cape Cod is 300 nautical miles. This gives an average daily drift of about 4 nautical miles.

The drift of these bottles indicates a surface movement of the water from the Bay of Fundy through the northwestern part of the Gulf of Maine, striking Cape Cod.

On August 29, 1919, drift bottles were set out off the coast of New Brunswick, one of them reaching the Azores on August 8, 1920. From the position in which this bottle was found it is believed that it approached the Azores from the north or northwest. Another bottle, dropped only a mile from the first one and at about the same time, was carried to the Cape Cod coast. It is presumed that the first bottle approached Cape Cod, but being a little farther east was eventually caught by the Gulf Stream and carried to the Azores as just related.

Still a third was put out at the same time about 6 miles northeast of that which went to the Azores. It was picked up on one of the northwestern islands of the Orkney group, on January 21, 1921.

According to the Toronto *Daily Star*, November 1, 1920, a sealed bottle cast into the ocean near Newfoundland in September, 1919, reached Nieuport, Belgium, in August, 1920.

A striking case of drift cited by Mr. Mavor was that of the derelict schooner, *Fannie E. Wolston*, which was adrift for two and a half years and was observed over 30 times. On December 15, 1891, she was seen in lat. 36° N. and long. 74° W. (northeast of Cape Hatteras), and four times afterward on her way across the Atlantic, until she reached lat. 35° N. and long. 39° W. on June 13, 1892, having covered in six months four-fifths of the course between the American coast and the Azores. After reaching the Azores she circled the Sargasso Sea and returned to the American coast by a southern route.

The following account (from the Washington *Times*, August 9, 1920) of the drift of one of the life belts of the ill-fated *Lusitania* furnishes an interesting case of the action of the ocean surface-currents:

PHILADELPHIA, August 7, 1920.—Scientists are greatly interested in the probable route followed by the *Lusitania* life belt recently picked up in the Delaware River off one of the city piers in the center

[1] Abstracted from *Science*, New York, Nov. 5, 1920, pp. 442–443, Feb. 25, 1921, pp. 187–188, and Apr. 22, 1921, p. 389: communications from James W. Mavor.